A HIGH RESOLUTION 3D IMPRESSION IMAGING DEVICE

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Introduction: The aim of this research is to develop a device which can be used to capture 3D and color images of tire track and footprint impressions in crime scenes. The device is easy to use, is non-destructive, and saves time during evidence collection. Computer-based pattern matching technology can be used to assist in matching and comparison tasks. The device will be comparable in price to the equipment currently used in the field and will produce better quality and metric data.

Methods: The device for digitizing the impression evidence consists of a motorized rail with a HD video camera and two line laser lights, each with a different color. The digitization process depends on triangulation geometry of the laser stripe in the image and the camera capturing this 2D image. The system is calibrated using a vanishing point method. The system software prototype is implemented using OpenCV library and C++ language. The system is tested capturing impression scans in different materials such as mud, clay, sand, and snow.

Results: Empirically, we have observed that we can resolve 0.5mm in depth values as reflected in detectable differences of at least 1 pixel in the computed disparity image. Our results also indicate that the 3D depth values produced using the 2 lasers stripes independently agree with each other over most of the pixels, confirming the accuracy of our model. In addition, the results from the two laser lights complement each other in parts of the surface where one of the laser stripes becomes invisible due to occlusions.

Conclusions: Our approach of using two lasers overcomes data loss due to occlusions. We also found out that laser detection in some materials like snow is a challenging task under daylight conditions. Future research will focus on optimizing laser detection and matching 3D depth images.

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